Fatigue as a Safety Risk in Flight Operations: Challenges and Opportunities

Mark R. Rosekind, Ph.D.
Board Member

CHC Safety & Quality Summit
April 1, 2014
1) determining the probable cause of transportation accidents

2) making recommendations to prevent their recurrence
All Modes
Independent Federal Agency: Created in 1967

- >132,000 accident investigations
- 13,500+ safety recommendations
- ~ 2,500 organizations/recipients
- 82% acceptance rate
“Swiss Cheese” Model (Reason)

Successive layers of defenses, barriers, and safeguards

Hazards

Accident

Successive layers of defenses, barriers, and safeguards
NTSB Go Team: 24/7/365

- Individual investigator
- Regional/limited team
- Major launch/Board Member
Key On-scene Events

Organizational Meeting
- Designate parties and party coordinators
- Establish and organize groups

Progress Meetings
- Summarize findings
- Info for briefings

Family Briefings

Press Briefings
NTSB Investigative Process

On-scene Investigation
Organizational Meeting
Groups and Parties
Progress meetings
Media Briefings
Press Releases

Preliminary Report
Fact finding
Depositions
Witnesses
Docket

Public Hearing
Fact finding
Depositions
Witnesses
Docket

Board Meeting
Docket
Findings
Conclusions
Probable Cause
Safety Recommendations

Final Report

Government in the Sunshine Act
NTSB: The Board

- **Five Members:**
  - President nominates
  - Senate confirms

- Mark Rosekind, Member
- Chris Hart, Vice Chairman
- Debbie Hersman, Chairman
- Robert Sumwalt, Member
- Earl Weener, Member
NTSB Characterized as:

‘moral compass and industry conscience’

NTSB Chairman Deborah A.P. Hersman
Go! Flight 1002

- early starts, multiple segment days, sleep apnea
Honorable John K. Lauber:

No Accident ≠ Safe Operation
Uncontrolled In-Flight Collision with Terrain
AIA Flight 808, Douglas DC-8-61, N814CK
U.S. NAS, Guantanamo Bay, Cuba, August 18, 1993

First NTSB aviation accident investigation
to cite fatigue as probable cause

- acute sleep loss, sleep debt, circadian disruption
Crew Sleep History

8/16/93

0000 0800 1600 2400

Capt. 8 h 9 h 2 h 17.5 h 5 h 23.5 h

F/O 8 h 9 h 2 h 19 h 8 h 19 h

F/E 9.5 h 15 h 6 h 9 h 6 h 21 h

8/17/93

0800 1600 2400

8 h 8 h 9 h 19 h 19 h

9.5 h 15 h 6 h 9 h 6 h 21 h

8/18/93

2400 0800 1600 2400

Accident MGUM

Sleep
Wake
Duty
Observed Performance Effects

• Degraded decision-making
• Visual/cognitive fixation
• Poor communication/coordination
• Slowed reaction time
“The National Transportation Safety Board determines that the probable causes of this accident were the impaired judgment, decision making, and flying abilities of the captain and flight crew due to the effects of fatigue…”
Owatonna, MN (July 31, 2008)

8 fatalities
Owatonna Crew Fatigue Factors

- acute sleep loss (Capt/FO)
- cumulative sleep debt (FO)
- early start time (Capt/FO)
- excessive sleep need (Capt)
- insomnia (FO)
- self-medicate/prescription sleep med (FO)
Contributing to the accident were . . .

(2) fatigue, which likely impaired both pilots’ performance; . . .
New Mexico State Police Helicopter
Sante Fe, New Mexico (June 9, 2009)
New Mexico State Police Helicopter
Sante Fe, New Mexico (June 9, 2009)

Impact area

Fuselage

New Mexico State Police Photo
Fuselage

Cockpit

Roof panel

Rear seat

New Mexico State Police Photo
New Mexico State Police Helicopter
Sante Fe, New Mexico (June 9, 2009)

- Contributing to the accident were . . .
  the pilot’s fatigue . . .

- Also contributing were . . .
  lack of an effective fatigue management program for pilots . . .
Challenges of a 24/7 Society
Four Fatigue Factors +

- Sleep loss
- Continuous hours of wakefulness
- Circadian/time of day
- Sleep disorders
- Other considerations
Sleep Requirement

Hours

6  7  8  9  10
Cumulative Sleep Debt

Sleep Need – Actual Sleep = Sleep Debt

Sleep debt grows cumulatively over time.
### Sleep Loss and Alcohol: Performance Equivalents

<table>
<thead>
<tr>
<th>Sleep loss (hrs)</th>
<th>12oz Beers</th>
<th>BrEC%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2 - 3</td>
<td>.045%</td>
</tr>
<tr>
<td>4</td>
<td>5 - 6</td>
<td>.095%</td>
</tr>
<tr>
<td>6</td>
<td>7 - 8</td>
<td>.102%</td>
</tr>
<tr>
<td>8</td>
<td>10 - 11</td>
<td>.190%</td>
</tr>
</tbody>
</table>

*Roehrs et al. Sleep, Vol. 26, No. 8, 2003*
Fatigue Risks

- awake/alert
- asleep

- reduced performance
- variability
Fatigue Risks

• degraded 20 – 50%+: 
  - reaction time
  - memory
  - communication
  - situational awareness

• increased: 
  - irritability
  - apathy
  - attentional lapses
  - microsleeps
Fatigue and Reaction Times

Alertness Reports Often Inaccurate

Subjective alertness

Physiological alertness

Adapted from Sasaki et al., 1986
MOST WANTED LIST

A program to increase the public's awareness of, and support for, action to adopt safety steps that can help prevent accidents and save lives.

The following are ten of the current issues:

- Addressing Human Fatigue
- General Aviation Safety
- Safety Management Systems
- Runway Safety
- Bus Occupant Safety
- Pilot & Air Traffic Controller Professionalism
- Recorders
- Teen Driver Safety
- Addressing Alcohol-Impaired Driving
- Motorcycle Safety
NTSB Safety Recommendations: Fatigue

• MOST WANTED 1990 - 2011

• ~200 fatigue recommendations
NTSB Safety Recommendations: Fatigue

• 40 years ago: May 10, 1972

• “Revise FAR 135 to provide adequate flight and duty time limitations.” (A-72-55)

• Classified “Closed-Unacceptable”
Complex Issue:

Requires Multiple Solutions

- Scheduling Policies and Practices
- Education/Awareness
- Organizational Strategies
- Healthy Sleep
- Vehicle and Environmental Strategies
- Research and Evaluation
NTSB Fatigue Recommendations: Education/Strategies

- Develop a fatigue education and countermeasures training program
- Educate operators and schedulers
- Include information on use of strategies: naps, caffeine, etc.
- Review and update materials
Scheduling Policies and Practices

Victoria, Texas, January 2, 2008

• Day sleep, night drive, ~ 4 am WOCL
NTSB Fatigue Recommendations: Hours of Service / Scheduling

• Science-based hours of service

• Allow for at least 8 hours of uninterrupted sleep

• Fatigue mitigation strategies in the hours-of-service regulations for passenger-carrying drivers who operate during the nighttime window of circadian low

• Reduce schedule irregularity and unpredictability
Sleep Apnea

Mexican Hat, UT, January 6, 2008

- 360 rollover, 50/53 ejected, 9 fatalities, OSA (-CPAP)
NTSB Fatigue Recommendations: Sleep Apnea/Health Related

- Develop standard medical exam to screen for sleep disorders; require its use
- Educate companies and individuals about sleep disorder detection and treatment, and the sedating effects of certain drugs
- Ensure drivers with apnea are effectively treated before granting unrestricted medical certification
NTSB Fatigue Recommendations: Fatigue Management Systems

- Develop guidance based on empirical and scientific evidence for operators to establish fatigue management systems.
- Establish an ongoing program to monitor, evaluate, report on, and continuously improve fatigue management programs implemented by motor carriers to identify, mitigate, and continuously reduce fatigue-related risks for drivers.
Examples

Fatigue Risk Management Systems
Implementation Guide for Operators
1st Edition
July 2011

Fatigue Risk Management Systems Manual for Regulators
2011 Edition
Manage Fatigue = Enhance Safety

- Acknowledge risks
- Educate everyone
- Strong policies
- Take action/use strategies!
- Promote culture change
Good sleep, safe travels.